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EXAMINER	
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ART UNIT	**PAPER NUMBER**
2878	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/786,443	CATHEY ET AL.	
	Examiner	Art Unit	
	STEPHEN YAM	2878	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 August 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *23-37* is/are allowed.

6)☒ Claim(s) *1-4,6,8,11,15,16 and 20-22* is/are rejected.

7)☒ Claim(s) *5,7,9,10,12-14 and 17-19* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/17/08*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This action is in response to Amendments and remarks filed on August 21, 2008. Claims 1-37 are currently pending.

Double Patenting

1. Claim 5 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 31. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Objections

2. Claims 12-14 and 22 are objected to because of the following informalities:

In Claims 12-14, "the non-linear digital detector" lack proper antecedent basis.

In Claim 22, "modifying the wavefront" lacks proper antecedent basis.

3. Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 15, 16, 20, and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Hammond, Jr. US 6,097,856 (hereinafter "Hammond").

Regarding Claim 15, Hammond teaches (see Fig. 2) a method for reducing aberrations in a wavefront imaged by an optical system having a non-linear detector (30) (see Col. 8, lines 63-67), comprising: encoding (24) a wavefront of electromagnetic radiation from an object (10) imaged to the non-linear detector; digitally converting data from the non-linear detector to form a digital representation of the image captured by the detector (see Col. 4, lines 43-45); linearizing the detected image to form a linearized image (to provide a proper gray scale image- see Col. 8, lines 54-56); and filtering (see Col. 9, lines 1-7) the linearized image to reverse effects of wavefront coding to form a final image.

Regarding Claims 16 and 22, Hammond teaches the step of encoding a wavefront comprises the step of coding the wavefront with a phase mask (24) that modifies the optical transfer function of the optical system by affecting the phase of the wavefront transmitted by the phase mask (See Col. 7, lines 23-31).

Regarding Claim 20, Hammond teaches the aberrations include one or more of misfocus (see Col. 7, lines 29-31), spherical aberration, astigmatism, field curvature, chromatic aberration, temperature induced misfocus aberration, and pressure induced misfocus aberration.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1-4 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cathey, Jr. et al. US 5,748,371 in view of Goodwin US 5,134,573.

Regarding Claim 1, Cathey, Jr. et al. teach (see Fig. 2) an optical system for imaging an object comprising: optics (20, 25) for focusing and encoding a wavefront from the object to an intermediate image (on (30)) such that an optical transfer function of the optical system, at the intermediate image, is more invariant to focus-related aberrations as compared to an intermediate image formed by the optics without encoding (see Col. 2, lines 37-42); and a non-linear detector (film, which is a non-linear detector) (see Col. 2, lines 43-46) for detecting the intermediate image (30). Cathey, Jr. et al. also teach the process reversing a transformation effect to provide an accurate final image (see Col. 2, lines 52-54). Cathey, Jr. et al. do not teach a linearization processor for linearizing the intermediate image to form a linearized image. Goodwin teaches a non-linear detector (12) for detecting an intermediate image (on the film 12) and a linearization processor (10, 14) for linearizing the intermediate image to form a linearized image (see Col. 3, lines 5-45). It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a linearization processor for linearizing the intermediate image to form a linearized image, as taught by Goodwin, in the system of Cathey, Jr. et al., to increase the practical linear range for proper contrast, tone, and image balance, as taught by Goodwin (see Col. 2, lines 15-22 and Col. 3, lines 5-16).

Regarding Claim 2, Cathey, Jr. et al. teach the optics comprise a phase mask that modifies the optical transfer function of the optical system by affecting phase of the wavefronts transmitted by the phase mask (see Col. 2, lines 49-51, 58-65).

Regarding Claim 3, Cathey, Jr. et al. teach the aberrations include one or more of misfocus (see Col. 2, lines 31-36), spherical aberration, astigmatism, field curvature, chromatic aberration, temperature induced misfocus aberration, and pressure induced misfocus aberration.

Regarding Claim 4, Cathey, Jr. et al. teach the non-linear detector comprises film (see Col. 2, lines 43-46).

Regarding Claim 8, Cathey, Jr. et al. teach a post processor for filtering the linearized image by removing effects of wavefront coding therefrom induced by the optics to form a final image (See Col. 2, lines 53-57).

8. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cathey, Jr. et al. in view of Goodwin, further in view of Bucourt et al. US 6,653,613.

Regarding Claim 6, Cathey, Jr. et al. in view of Goodwin teach the device in Claim 1, according to the appropriate paragraph above. Cathey, Jr. et al. do not teach the optics comprise an optical element with an aspheric phase profile. Bucourt et al. teach a similar device with optics comprising an optical element with an aspheric phase profile (see Col. 5, lines 13-15). It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the optics comprising an optical element with an aspheric phase profile, as taught by Bucourt et al., in the device of Cathey, Jr. et al. in view of Goodwin, to provide wavefront coding patterns that are optimized to correct focusing aberrations for a clearer image.

9. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cathey, Jr. et al. in view of Goodwin, further in view of in view of O'Meara US 3,988,608.

Regarding Claim 11, Cathey, Jr. et al. in view of Goodwin teach the device in Claim 1, according to the appropriate paragraph above. Cathey, Jr. et al. do not teach the non-linear detector comprising a non-linear digital detector. O'Meara teaches a similar device with adaptive wavefront optics and a non-linear digital detector (see Abstract). It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the non-linear detector comprising a non-linear digital detector, as taught by O'Meara, in the device of Cathey, Jr. et al. in view of Goodwin, to electronically capture an image and improve contrast resolution, as taught by O'Meara (see Col. 2, line 67 to Col. 3, line 2).

10. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hammond, Jr. in view of Cathey, Jr. et al.

11. Regarding Claim 21, Hammond teaches the method in Claim 15, according to the appropriate paragraph above. Hammond does not teach the non-linear detector as an analog film. Cathey, Jr. et al. teach a similar device with a non-linear detector as either an analog film or a digital detector (see Col. 2, lines 43-46). It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the non-linear detector as an analog film, as taught by Cathey, Jr. et al., in the method of Hammond, to provide a permanent and physical storage of an image compared to an electronic storage.

Allowable Subject Matter

12. Claims 23-37 are allowed over the prior art of record.

13. Claims 5, 7, 9, 10, 12-14, and 17-19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims and overcoming any claim objections set forth in this Action.

14. The following is a statement of reasons for the indication of allowable subject matter:

Regarding Claims 5 and 23, the invention as claimed, specifically in combination with the nonlinear detector having an intensity threshold, wherein any part of the intermediate image that is below the intensity threshold is not detected by the nonlinear detector, is not disclosed or made obvious by the prior art of record.

Regarding Claims 9 and 17, the invention as claimed, specifically in combination with the linearization processor linearizing the intermediate image by measuring an exposure curve within an image detected by the non-linear detector and by converting the exposure curve into a substantially linear exposure curve, is not disclosed or made obvious by the prior art of record. The prior art of record incorporates a pre-determined exposure curve and does not measure the particular image for the exposure curve.

Regarding Claim 18, the invention as claimed, specifically in combination with linearizing the detected image comprises the step of: determining the approximate value of the highest density in the image detected by the non-linear detector; wherein converting the exposure

curve into a substantially linear exposure curve comprises: generating a look up table by solving for integer values on the exposure curve between the approximate highest density value and a low density value; and mapping the values in the look up table onto the substantially linear exposure curve., is not disclosed or made obvious by the prior art of record.

Regarding Claim 19, the invention as claimed, specifically in combination with the filtering of the linearized image of the wavefront is performed by the filter defined by the Fourier-domain equation as recited in the claim, is not disclosed or made obvious by the prior art of record.

Response to Arguments

15. Applicant's arguments filed August 21, 2008 have been fully considered but they are not persuasive.

Applicant argues that Hammond does not teach a "non-linear detector for detecting the intermediate image" as the detector in Hammond is a linear detector (Applicant's 8/21/2008 arguments at 15). Examiner asserts that Hammond discloses

> "Each of these elements has an amplitude which is proportional to the time averaged result of the superposition of the squares of the absolute values of the coherent PSFs of all points of the object that are projected onto the respective photo sensitive elements" (Col. 8, lines 63-67, emphasis in underline)

Thus, Examiner asserts that the detector of Hammond is a non-linear detector as it captures the squares of the absolute values of the coherent PSFs and thus, is non-linear with respect to the values of the coherent PSFs (a square transformation is a non-linear transformation). As such,

Examiner asserts that Hammond discloses the limitation of a non-linear detector as recited in Claims 1 and 15.

As Applicant has amended Claim 1 to recite that the linearization processor is "for linearizing the intermediate image to form a linearized image", Examiner agrees with Applicant's arguments (Applicant's 8/21/2008 arguments at 15) that Hammond does not disclose such a limitation. Applicant's amendment has necessitated a new ground of rejection for Claim 1 as recited in the appropriate section above.

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHEN YAM whose telephone number is (571)272-2449. The examiner can normally be reached on Monday-Friday 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Epps can be reached on (571)272-2328. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Stephen Yam/
Primary Examiner, Art Unit 2878